

ries in the distribution and structure of the lesions were so numerous that no two sets of lungs were similar in appearance, and often one lung differed markedly from its fellow.

6. In the pandemic disease of 1918, acute degenerative changes in the heart muscle, liver and kidneys were neither frequent nor intense. In the recurrent disease, they were both common and severe. In the pandemic, the blood cultures were almost invariably sterile; in the epidemic, streptococcal septicemia occurred, we estimate, in about 10 per cent. of all pneumonias.

## YELLOW FEVER CONTROL IN ECUADOR

### PRELIMINARY REPORT

M. E. CONNOR, M.D.

Field Director, International Health Board

GUAYAQUIL, ECUADOR

The files of the National Board of Health of Ecuador show that the first recorded epidemic of yellow fever in the country occurred in the city of Guayaquil in the year 1842, and it was estimated at that time that one half of the population of the city died from this disease during the epidemic.

Yellow fever was probably introduced into Ecuador from Panama by the earlier settlers soon after the appearance of the disease at Panama, and has probably been present in Ecuador since that time, notwithstanding the fact that the records of the sanitary department report as many as three consecutive months in one year having passed without a single recognizable case of the disease. It undoubtedly was present, but in a type so benign as not to be easily diagnosed, especially in children.

The Gorgas commission of the International Health Board in a world survey for endemic yellow fever centers reported that this disease could be "eradicated from the west coast of South America by eradicating it at Guayaquil, Ecuador," and recommended that the attack be made by destroying the stegomyia breeding places in that city.

Arrangements were entered into with the Republic of Ecuador for a cooperative campaign with its national health agency on the following basis:

1. The National Board of Health of Ecuador would supervise the isolation of yellow fever patients and fumigation of houses as might be attempted.
2. The International Health Board would concentrate its efforts on mosquito-proofing the necessary water receptacles, that is to say, antilarvae measures.

The built-up area of Guayaquil occupies about 3 square miles, has a population of 90,000, and contains nearly 6,000 buildings. The average annual rainfall is 60 inches, and occurs principally during the months of January, February, March and April—a relatively short and light rainy season for a tropical city. The elevation of the city above mean tide is about 2 meters, and the topography is that of a plane.

The water supply is taken from a river about 90 kilometers northeast of the city. The present supply provides for 40 liters per capita each day and is delivered from storage tanks through a system of mains for about four fifths of the city area. The ration of water is available in the morning for one and one-half

hours only. That part of the city in which it is not possible to make house connections is served by water venders and from public taps or fountains.

The scarcity of water, therefore, makes it obligatory on the residents to store sufficient water for their needs in tanks, barrels and like receptacles.

### ANTILARVAE MEASURES

That yellow fever is a place disease is a generally accepted fact. The spot map of yellow fever cases occurring in the city of Guayaquil during the year 1918 brings this out quite clearly, and shows that the vast majority of cases reported up to November of that year occurred in the most densely populated section of the city, or rather in that section in which houses had been erected without any intervening space. A survey of this district revealed the important fact that the vast majority of homes were supplied with from one to twelve water tanks each, in addition to the barrels and smaller receptacles, while the outlying districts depended almost entirely on smaller receptacles, very few tanks being used. Many of the tanks inspected were uncovered or so badly covered that the mosquito experienced no difficulty whatever in gaining access to the water within. The barrels and other receptacles were all uncovered. All tanks inspected on this survey were found to contain the stegomyia larvae; the smaller receptacles were also breeding places, more especially for the culex; and in two instances I noted stegomyia larvae in tanks, while in barrels in the same room only culex larvae could be found.

The stegomyia is essentially a house mosquito, that is to say, it breeds, lives and dies in the same house, it does not fly for any considerable distance, and it avoids bright sunlight; only under rare circumstances is it to be found breeding in streets, yards or fields, at least in Ecuador, and up to now we have not found this extraneous breeding of sufficient importance to be considered a factor in the present campaign.

The antilarvae measures were started Nov. 25, 1918, and were based on the findings of the early survey. The first step was to mosquito-proof all tanks as soon as possible, and the organization concentrated its efforts on this work during the earlier weeks of the campaign.

A graph to be published later will show that yellow fever cases decreased rapidly as the tanks were made mosquito-proof; and when the number of breeding places in tanks were reduced to 5 per cent. of the total number inspected, the disease had been controlled, but was not considered eradicated. This reduction was taking place during the height of the rainy season and while receptacles of water, other than tanks, still remained stegomyia breeding places.

Nearly all tanks used in the city for conserving water are made in the country, are rectangular, and have a capacity of from 10 to several hundred gallons. The water enters the tanks from above, the inlet pipe resting on the top of one side of the tank; the outlet pipe is usually from 1 to 2 inches above the level of the tank floor, and even when the tanks are empty, so far as getting any water from them by means of the faucet is concerned, there always remains enough water in the tank for an ideal breeding place for the mosquito. This fact explains in part why tanks are a more desirable breeding place for the mosquito: this class of water container is seldom without water, and the surface of the water is disturbed only during the morning for one hour or so.

In the barrels and the smaller containers, conditions are not so favorable for the mosquito, as the water is always taken from these containers by means of a pail or large cup and always from above; consequently, during daylight hours there is considerable movement of the water surface which is not conducive to the selection of this class of receptacle as a breeding place by a mosquito of the habits of the stegomyia; and further, there comes a time rather frequently in the dry season when the barrel and similar receptacles are empty by reason of the scarcity of water or for purposes of cleaning the container, a condition that does not obtain with tanks, at least with the same frequency. It is fair to assume that if the stegomyia mosquito can exercise the instinct for self preservation, it will select and even hunt for water in a tank in which to deposit her eggs as offering a more favorable opportunity for the development of same as contrasted with chances in a barrel or similar receptacle.

The present campaign has been based on the thought that with a reduction of stegomyia mosquito breeding in water tanks there should be a reduction in the number of cases of yellow fever, and that if the effort is continued the disease will be eradicated. All containers of fresh water in or near human habitation have been treated; but the thought to be conveyed is that the tanks as water containers have been given first consideration.

There are nearly 7,000 water tanks in use in the city, and nearly 30,000 other containers to be inspected. The tanks have been covered with either copper screen, galvanized iron, or wooden covers. Of the three classes of covers, the galvanized iron has proved the most satisfactory and the cheapest; they do not admit of contamination of the water by rats, which is possible with copper screening; nor can they be taken and used for fire wood, as sometimes happens with wooden covers.

Great care is taken that the tanks are so covered that the mosquitoes cannot gain entrance to the water within. We impress on the people that the mosquito is a small insect and naturally can penetrate a small opening. Tanks with perfectly fitting covers are sealed, bearing the stamp of the service, in a manner that the cover of the tank cannot be raised without breaking the seal, and a broken seal indicates to the inspector that a careful inspection of the tank must be made to determine whether the cover has been off long enough for the mosquito to deposit her eggs within.

Public opinion for the work was created through the press, public lectures, posters, handbooks, etc. Yellow fever had so long handicapped and actually retarded the progress of Guayaquil and Ecuador that the public was ready to cooperate in any measure that would aid in the control of this disease, and this effort has been most intelligent and constant. Owing to the scarcity of water, especially in the dry season, it was highly desirable that we should adopt some measure that would free the water containers of mosquito larvae and at the same time conserve the water to the people, and accomplish this result economically. We experimented with different species of fish to determine their usefulness as mosquito larvae consumers.

The first variety of fish used is known locally as the "huaijas," a member of the perch family. This fish readily eats mosquito larvae, but soon tires of its existence in a barrel or small receptacle, and will jump

3 and sometimes 4 feet to free itself from the container. The jumping properties are most often exhibited during the night. It will be readily seen that even when people are willing and anxious to conserve the fish in their water containers, they can hardly be expected to watch them during the night. To counteract this jumping, the service supplied covers for the barrels; but here again we encountered difficulty in keeping the covers on the barrels, and there are good local reasons why it was not desirable to insist that all barrels be equipped with covers and the water drawn off by faucet. We were forced to abandon the huaijas, on account of its jumping, for the chata, a small fish which proved to be a voracious eater of mosquito larvae. It has the additional property of spending the greater part of its time at the surface of the water; but when any one approached the container, the chata would immediately swim to the bottom, remaining there until the cause of its fright had been removed.

The chalaco also was tried out and has given very good results. Top minnows or "millions," were given a trial, and are quite satisfactory for certain class of containers. These fish are very delicate and do not survive long in the ordinary container unless some care is given to them. As long as fish are available, they will be used for all containers other than tanks.

The present campaign was actually started, Nov. 25, 1918, with twelve sanitary districts. The number of districts was gradually increased up to twenty-nine. This number was maintained for a few months, when reduction was permissible. Oct. 1, 1919, the city was redivided into ten sanitary districts. The inspection cycle was arranged so that every home in the city should be visited at least once every seven days, including Sundays. Sanitary inspectors started in their districts on Monday, and those not able to conclude on Saturday were aided by auxiliary squads.

On the farms outside the city of Guayaquil, all large containers were eliminated; and as these farms are usually located on the river and the homes of the laborers on the banks of the river, it was decided to recommend that receptacles holding not more than 5 gallons of water be used in place of barrels. It had previously been observed that the vast majority of the laborers do not use in their homes more than 5 gallons of water in twenty-four hours. Bathing, washing of clothes, etc., is usually done in the river, so that there is really no need for conserving water longer than twenty-four hours in the homes. By this method it is believed that the stegomyia mosquito can be eliminated in those areas where this measure can be put in force.

---

**Death and Blindness Caused by Wood Alcohol.**—Owing to the heavy increase recently noted in the number of deaths and cases of blindness resulting from the drinking of wood alcohol by those ignorant of its dangers, the National Committee for the Prevention of Blindness, 130 East Twenty-Second Street, New York, is sending broadcast special warnings of the tragic consequences which may follow the use of wood alcohol, denatured alcohol and medicated alcohol for beverage purposes. The harmful action of this poison comes not only from taking it internally, but may likewise be induced by breathing its fumes, and by absorption through the mucous membranes of the body. Its effect is usually noticeable very shortly after exposure. Within a few hours after drinking, acute headache is noted, usually accompanied by violent attacks of vomiting, body pains, extending over the region of the kidneys, and excessive dizziness. Vision may become impaired, total blindness occur, and death itself result.—*Illinois Health News*, October, 1919.